THE

ORIGIN

OF THE

MATERIAL UNIVERSE;

WITH

A DESCRIPTION OF THE MANNER OF THE FORMATION OF THE EARTH, AND EVENTS CONNECTED THEREWITH, FROM ITS EXISTENCE IN A FLUID STATE TO THE TIME OF THE MOSAICAL NARRATIVE.

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PREFACE.

In presenting the following thoughts or reflections to the public, the writer is aware, that some errors of diction, if not of logical deduction, may have escaped unnoticed. The work was written at intervals, during which his professional duties required his unremitting attention.

In endeavoring to avoid technicalities, and to render his subject intelligible to the general reader, some repetitions may have been introduced, which, upon

a careful revisal, might have been avoided.

It is believed, the explanations given in the following pages will furnish data, which will account for most of the phenomena, hitherto not clearly expounded, in relation to the external appearance and condition of the earth's surface; and indicate the cause of the deposits of marine shells, and animal remains, on the hills, at great distances from the ocean.

The writer believes, that if the whole theory proposed is not deemed visionary, some part of it, at least, will lead to investigations that will confirm the truth of the suggestions thus hastily intimated.

Many of the ideas advanced are believed to be original; — they so suggested themselves to the mind of the

writer; and, although the expressions may not be clothed in habiliments which might render them attractive to the critical acumen of the scientific artist, still, it is thought, the material offered may be wrought into such shape and fitness, by the aid of his skill, as to present, to the mind's eye, a picture of the earth's surface, as it once appeared, — which may be viewed and reflected upon, with both pleasure and instruction, by a large portion of its present race of intelligent inhabitants.

INTRODUCTION

THE subject of the formation of the Material Universe has engaged the attention of mankind, and been the theme of conjecture and doubt, of assertion and contradiction, from the commencement of the first historical record to the present time. It has been a topic on which the ingenuity and learning of philosophers of profound knowledge have been exhausted, without arriving at any definite result. Even the Inspired Writings furnish us with no

evidence of the *manner* in which the "Heavens and the Earth were created," or of the changes that took place on them prior to the Mosaical Narrative.

The theory now presented was suggested by, and, in fact, is founded on, the supposition, that the earth was formerly a fluid mass, of a temperature so high that water could not possibly have existed on or near its surface. The writer is not aware, that any attempt has yet been made, to account for the *method*, employed by the Creator, for the formation of water; or, at what particular stage of the earth's existence, it became a component part of its exterior, under the present order of its arrangement.

For the purpose of explaining, to those of our readers who may not be

acquainted with the elementary components of water, or the manner of their union, we will premise, — that the atmosphere, which surrounds the earth, is composed of two kinds of air, called oxygen and nitrogen gases, in the proportion of one part of the former, to four of the latter; while water is composed of oxygen and hydrogen gases, in the proportion of eight parts, by weight, of the former, to one of the latter. Hydrogen and oxygen gases may be chemically combined, by combustion, in the following manner: — Let a quantity of hydrogen gas be brought in contact with the flame of a burning candle, in the air, and the oxygen of the atmosphere will combine with the heated hydrogen of the candle, and water will be formed by the com-

bustion. This combination may be observed by any one, on applying a lamp-glass, or chimney, over a burning lamp. The hydrogen of the flame (one of the components of oil being hydrogen) will unite with the oxygen of the air, and will be condensed, in the form of vapor, on the inside of the glass. This process is continually going on during the burning of any substance containing hydrogen; although, in the above process, the vapor will be visible only so long as the glass is sufficiently cool to condense it, as it is formed.

Oxygen occupies the most important place in nature. No organized being could exist without it; and yet, nothing is more destructive to life. No fire could burn without it; and yet, to this very property of its being a supporter

of combustion, in connection with hydrogen, which is very inflammable, are we indebted for the only material capable of arresting the progress of combustion, — water. Thus, then, the same materials, differently combined, support life and combustion, and destroy them. Most metals have the property of decomposing water, by uniting with its oxygen ; when the hydrogen, being liberated, is again set free in the form of gas. If this latter gas is again inflamed, it will unite with the oxygen of the atmosphere, and water will be formed. During the intense heat evolved from burning buildings, if a *small* quantity of water be thrown upon them, the fire is increased, — the water is decomposed, the oxygen unites with the combustible substance,

the hydrogen escapes, and is inflamed; — and the only means, known to man, for averting the calamity, serves but to increase its destructive energy. Again: if the heat evolved from a body (molten metals, for example,) be sufficiently intense, the oxygen will be expelled, and will not again combine with it till the temperature of the body be sufficiently reduced to reproduce its affinity for this gas.

Had the gases, oxygen and hydrogen, not existed, fire, air, (as now constituted,) and water, with all their dependents, — such as life, light, sound, &c., would have been unknown; and the earth would have presented an appearance like that of shining metals, brilliant to the eye, (had there been eyes to see it,) but totally unfit for the hab-

itation of any thing endowed with the principle of life, or pertaining to organized beings, as now constituted.

Assuming, therefore, as a conceded fact. the former fluidity of the earth, and that it has been gradually cooled, by parting with its caloric of fluidity, we have endeavored to account for the manner in which it became fluid; and have supposed, that the same causes acted on all the material universe,—that similar effects with those we have described as pertaining to the earth, were produced on the other orbs rolling through space.

We have then left the last, to continue revolving in their appropriate orbits, and have endeavored to trace the effects produced, on the surface of the earth, by the gradual accumula-

tion, or formation, of water around it; and its action upon it when allowed to come in contact with it.

We have briefly given the result of our reflections, from that time, to the time when the central heat yielded to the action of external influences, and the earth was prepared for the abode of the race of animated beings which have since occupied it.

We have, further, suggested the probability, that the heated waters became the medium of chemical, vegetable, and vegeto-animal organization;—the last deriving their vegetable or embryotic life, and growth, from the chemical materials diffused in the water, and there being prepared with organs adapted to, and with a capacity to fit them for, the great change im-

parted to their organization by subsequently coming in contact with, and imbibing oxygen from, the atmosphere. The action of this oxygen upon the blood, or sap, imparted to them a new kind of vitality, which enabled them to maintain the uniform temperature which they had received while *vegetating* in the waters.

That the whole surface of the earth was covered with water, for a long time, and that the waters were inhabited, is clearly indicated by the discovery of shells, and the remains of marine animals, on the highest mountains. That some kinds of animals were formed before others, is a fact also generally conceded.

A certain temperature may chemically combine some elementary particles

of matter, while a different temperature would separate or decompose them. Thus, hydrogen and oxygen will combine, and form water, when the temperature of the former is elevated to a certain point; but not otherwise. Let us suppose, that, under a certain condition, two or more particles of matter were attracted towards each other, and united, and, by some means, invested with life. We know that they would become capable of attracting other particles of inanimate matter, to a certain extent; and, that the vital principle would be communicated to the whole mass. Hence, we perceive, that the vital principle is *diffusive.* The most minute seed, or seminal germ, requires only a certain uniform temperature, accompanied by humidity, to stimulate

its powers of attraction or growth,—thereby rendering it capable of appropriating to itself all the materials necessary to its further development.

We have shown, in the following pages, that the waters on the earth's surface possessed all the requisites for the development and growth of organized matter; and have supposed, that, under their high and uniform temperature, as they contained all the materials of organized bodies, a union of the vital principle with an organization fitted for its reception, might have taken place. If it be admitted, that such union might be formed in the lowest orders of vegetable or animal organization, it is believed that all the requisites existed, in the waters and the atmosphere, during the very gradual reduc-

tion of their temperature, for the production of the whole.

It is believed, that water alone, either in a state of decomposition into its original elements, or by being converted into steam, was capable of producing all the convulsions under the earth's surface, and, consequently, all the elevations upon it; — and, with the aid of caloric, and electricity, and the other gases external to the earth, while it remained in a fluid state, of producing all the changes that have ever taken place upon it, since its fluid formation.

If our theory be the true one, the sun, and other luminaries of the universe, that generate their own light, are influenced by the same principles that controlled the earth's atmosphere, before

water was allowed to come in contact with its surface, — to wit, the union and decomposition of the elements of water. Owing to the immensity of the sun's mass, it will readily be perceived, that a very much longer time would be required to reduce the temperature of the surface sufficiently to allow water to approach it, without being decomposed. Whether this process of cooling is now going on at the surface of the sun, by which the solar system would be eventually deprived of the light and heat imparted by that luminary, or whether the decomposition and recomposition of water is kept in exact equilibrium by the caloric emitted, by which its heat would be kept up for ever, are questions very difficult of solution, at present.

Assuming the position we have laid down, in the commencement of our treatise, to be correct, — that the space occupied by the material universe has, from the creation, been filled with precisely the same materials as at present, — that these materials existed in the form of gases, and were kept in that state by caloric, which, with electricity, existed in a latent or passive state, until the Creator saw fit to arrange them in the order which enabled them to unite, or be condensed in masses, and to be governed thereafter by natural laws which He had impressed upon them, — it will need little aid from the imagination to conceive, that, should the Almighty, at any time, annul those laws by which the particles of matter had been attracted towards each other, and

towards the several centres assigned for them, they would immediately be dispersed through the space occupied by them before suns and planets were formed. The particles of matter, composing the suns and planets, would be repelled, and made to fly, with immense rapidity, through space; and, the caloric being diffused among them, would cause them to separate, ignite, and "the elements would melt with fervent heat," and, from liquid masses, become vapor; and, finally, be again decomposed, to take their place in space, in the gaseous form assigned them before their formation into suns and planets.

Every material body, with which we are acquainted, has its beginning, its maturity, and its decay, — this last converting it again into its original elements.

The change of matter from a gaseous to a solid state, and *vice versa*, is constantly going on before our eyes. There is nothing bearing the name of matter, with which we are acquainted, that is not subject to this law of change. And, is it to be supposed, that this law is confined only to the surface of the earth, or to the matter endued with the vital principle? May it not be equally enforced through all space, wherever matter exists? And, may not this law of change have existed from eternity, — and be continued through eternity? May not the same matter, which now composes the solar system, have been reduced to its gaseous form, and reformed, into systems of planets, and a sun, a thousand times before?

Whence is the beginning and ending of eternity? or, who can assign the bounds to infinity? Who shall measure the length and breadth of space, or count the mighty orbs that roll around the centre of centres, — the throne of the Eternal? The all-seeing, all-pervading Ruler and Lawgiver of the Universe, — in whom alone there is no change.

ORIGIN OF THE MATERIAL UNIVERSE.

CHAPTER I.

Anterior to the visible existence of suns and planets, the elements of the present innumerable systems, comprising the universe of matter, existed in space. Ere time was, even from eternity, alone in the inconceivable immensity of the void now occupied by the material universe, — even "in the beginning,"— God, the Eternal, the Great First Cause, filled the then material void with His presence. His fiat went forth, and the material creation began. Progressively and harmoniously each particle of matter assumed the space allotted to it. Definitely and mathematically were the elements of the universe proportioned to the space to be occupied by them. Above, below, to the

north, the south, the east, and the west, the invisible elements of future suns and planets came into being, throughout the immeasurable expanse. The height, and depth, and length, and breadth of boundless infinity were replete with unnumbered suns and worlds,—but existing in a gaseous state, invisible and subtle as the air that now surrounds the planet we inhabit. Light was not, except as it existed in a latent form, diffused equally through the apparently boundless void. Latent heat, or invisible and insensible caloric, too, pervaded the universe of matter, of which there was just enough to maintain the elements in their gaseous form. Motion was not,—for the mandate of the Almighty had not yet gone forth to disturb the repose of the new creation; and the Spirit of God was at rest, for the work of creation had been accomplished. Self-existent from eternity, omnipresent, alone in His majesty and power, yet existing in the most remote atoms at the same instant,—all-seeing,

all-pervading, all-controlling, from eternity to eternity, — He saw the beginning and the end.

In the centre of this invisible universe, He then formed a solid nucleus, by condensing a portion of the gaseous matter which he had formed ; and a vacuum was produced around the nucleus, where the condensation had been effected, — the matter forming the nucleus occupying much less space than before, — by which an impulse was given to all the material universe, — in the same manner that air or wind is carried from a denser to a rarer medium, or partial vacuum, — which impelled it towards this central vacuum ; the laws of the attraction of cohesion and gravitation were promulgated ; the latent caloric was set free ; and, throughout the vast expanse of boundless infinity, all was activity, motion, and life. Particles uniting with particles, forming masses, and flying in all directions towards each other, became ignited and fluid : small masses being merged in larger, were carried

along with them towards the common centre; but, attracted from their course by approaching other masses, and being absorbed by them, or carried around them by the centrifugal and centripetal forces: all finally assuming the same direction around their centres; for, the masses taking an opposite direction would meet, and unite, the smaller with the larger, and be carried along with them; or, be finally absorbed in the central mass; or, be kept at uniform distances by the action of the forces above named. These masses, as they united with each other, being in a fluid state, would assume and retain the globular form, however often their masses might be enlarged by uniting with others. Thus, these liquid masses rolled through space, frequently crossing each other's track; — some, passing others, were checked in their onward course by their attraction, and made to assume a direction around them; others, coming in contact with sufficient force to carry off a part of the mass

they had invaded, and changing the direction of each.

This apparent chaos of matter continued till all the fluid masses became subject to uniform and fixed laws of motion and direction; and, although all the masses, before being formed, received an impulse or attraction towards the common or great centre of centres, when the first vacuum was educed, and the first condensation of the gases took place, yet, the laws of the attraction of cohesion and gravitation acting alike on all created matter, the smaller masses would be attracted by the larger, and the larger in a less degree by the smaller, thus causing each to deviate from its regular course, — the larger masses forming new centres, to which the smaller would be attracted, and, if not subjected to the laws of the two opposite forces, would be united to the larger, and move onward in the direction given them by the laws of motion.

Finally, the whole matter of the material uni-

verse was arranged in spherical masses, and subjected to the laws of attraction and force, and rolled through space, at such distances from each other as their several laws of motion or gravitation required: — it being understood, that all the masses which had not arrived at the exact point where the centrifugal and centripetal forces were equal, had been united to other masses, until these laws governed the whole universe of matter. Then, what ineffable splendor pervaded the universe! What light indescribable emanated from these immense masses of ignited and molten matter! Imagine, for a moment, a universe, visible only to the eye of the Great Creator, created by Him in a form so subtle and spiritual, that, had man then existed, the whole unformed masses of suns and worlds would have been above, around, and in every direction, as they now are, but in a state as invisible to finite eyes as the gases which now pervade the atmosphere of our earth, — suddenly

made to assume the form of immense globes of fire, and impelled with inconceivable velocity through space! Well might the All-Wise, who had created, weighed, measured, and reduced to harmony and order the materials which had filled all space, before He subjected them to the laws of attraction, have pronounced them "*good.*"

But many of the gases, so called, such as now pervade the atmosphere of our earth, were not reduced to a state of fluidity, but were attracted towards the molten masses, without being allowed to unite with them; the globes being composed of substances to which man has since given the name of *metallic*, including primary rocks. These metallic globes, then, in consequence of their high temperature, would at once expel all the gases, which, if suffered to approach them, would deprive them of their lustre: — so that we may suppose their surfaces to have presented the appearance of polished metals, surrounded by an atmosphere of flame, each pre-

senting a light and brilliancy, in proportion to its magnitude, like that of the sun at the present time. These metallic masses, or globes, after their motion had become uniform, were arranged in layers or strata, — the heavier or more dense, such as platinum, gold, &c., being attracted towards the centre of gravity of each globe, and those of less density lying nearer the surface.

The great central mass, or centre of centres, or first nucleus, which gave an impetus to the remotest atom, and a tendency to fly towards it, till its direction was changed by other attractions, we may suppose bears about the same relative proportion to all the suns and planets revolving around it, as to size and weight, that our sun does to the planets, primary and secondary, of the solar system.

Finally, throughout the length and breadth of an endless infinity, all became harmony, uniformity, and action. Suns, in inconceivable numbers, with innumerable planets revolving

around them, their polished, glassy surfaces glittering with blazing light ineffable, as their radiating caloric was expelled from them! Imagination can hardly conceive of the dazzling splendor of the spectacle then exhibited.

CHAPTER II.

In our first chapter, we left the suns and planets of the universe, in a liquid or molten state, whirling through space around each other, and around the great central sun; each being accompanied by an intensely brilliant flame, or light. Here let us leave them, for the present, and confine ourselves to the planet we inhabit.

The earth, then, we will suppose, presented a smooth and glassy metallic surface, with a temperature sufficiently high to keep all its component parts in a liquid state, and surrounded by, though not in contact with, oxygen, hydrogen, nitrogen, and carbonic acid gases. These gases

had been expelled from the matter composing the earth at that time, by the immense heat acquired in its passage through space, (for, it will be recollected, that the latent caloric, which had kept all matter in a gaseous state before the laws of attraction had been promulgated, had been set free,) but were attracted towards it, to be in readiness to subserve the purposes required by the Creator. Carbonic acid gas, being the most dense, would first approach the earth as its temperature diminished, did not other effects intervene to prevent it. The caloric escaping from the heated surface of the earth ignited the hydrogen, which, attracting oxygen, was condensed, or converted into water, — producing a brilliant flash of light, accompanied by heat. This water, being more dense or heavier than the gases in a separate state, would be attracted towards the earth's surface, in a state of extremely minute vapor; but would be decomposed long before reaching it, and be again

converted into its original elements, — oxygen and hydrogen gases.

This process of conversion of these gases to water, and of decomposition, would continue until the earth's surface became sufficiently cool to admit the water to come in contact with it. This conversion of the gases into water would be incessant, and produce a constant blaze of light and heat, — at first remote, and afterwards nearer the earth's surface, — until all the oxygen and hydrogen had been combined, in due proportions, in the form of water; or, until the temperature of the exterior had become reduced too low to afford the heat required to unite them. The ocean's bed would then be many miles from the earth's surface, and so rare that the light from the earth might be seen through it at immense distances. But, as the heat at the earth's surface would be constantly diminishing, the water would be finally admitted to it, but in a state of extremely minute vapor, which would

be instantly decomposed, — not, however, in this instance, without producing a change on the surface of the earth; for, the oxygen would be attracted to the metallic surface, and, uniting with it, would oxidize or rust it; thereby producing a thin coating, or crust, and for ever depriving it of the brilliant lustre which, till then, it had exhibited. The hydrogen would escape, to be united with more oxygen, and form water. This oxide, or rust, gradually accumulating, and being a bad conductor of heat, would materially aid in reducing the temperature of the exterior of the globe.

While this process was going on, the temperature of the exterior of the earth, becoming constantly reduced, would gradually admit the water in a more condensed form, which would eventually come in contact with it without being decomposed. Ages must, however, have elapsed before the water could have been suffered to approach the heated exterior in a liquid state; —

even then, it would be kept at a boiling heat for a long time, and be evaporated in the form of steam, which would retard its accumulation, but would serve to reduce the temperature more rapidly, by carrying off vast quantities of caloric, in the aqueous vapor, to a colder medium, where it would be liberated, and the vapor again condensed, to fall towards the earth in the form of rain. This process would probably continue till the temperature of the exterior of the earth had been reduced below 212° of Fahrenheit, when the waters would be allowed to remain on the surface of the earth; and, if no other causes intervened, they would be equally diffused or spread over its whole surface, — subject only to the laws of vaporization and condensation, which are known to act far below the temperature above named.

But how different was the result! Fortunate inhabitant of this planet! couldst thou have then existed, organized as thou now art, what terrors

would have awaited thee! As one who finds himself upon an ice-clad ocean, hundreds of miles from the shore, and suddenly finds it breaking up around him, while between are gushing forth torrents of liquid fire; and sees his only foothold separated from its neighbor, expecting every moment to be swallowed up by the upheaving waves; — such wouldst thou have been, hadst thou then existed!

But, to return: — the accumulating waters, upon the solid but still heated crust, caused it to crack, and, penetrating through it to the fluid metals beneath, was converted into steam, or decomposed; and, as it expanded, forced the crust asunder, and escaped, carrying with it a quantity of the fluid mass. These explosions, owing to the small resistance of the thin crust, were very frequent; and the earth's surface, in a brief space of time, underwent an entire change in its external arrangement. Instead of the smooth and perfectly even surface, hills and

valleys were formed; but they were small compared with the immense mountains that now point toward the heavens. As the crust became thicker, the resistance being greater, a larger quantity of water would be retained, for a longer time, under the crust, which, being decomposed, or converted into steam, by the igneous fluid, would burst forth from its prison, and force the barrier to its escape, upwards, in immense masses. Then would the fluid matter rush in, under the raised mass, to fill the cavity, and a valley would be formed on each side of the hill, corresponding to the mass removed. Then, too, would the waters rush from the hills to the valleys, carrying with them every thing detached from the hills which fell in their way. All was commotion, uproar, and chaos, upon the exterior of the planet we inhabit; but within, beyond the reach of the agitation, caused, as before stated, by the action of the external gases, the most dense fluids, having gradually subsided towards the

centre, in proportion to their density, or specific gravity, where (except in cases where a portion of them have been thrown to the surface by subterranean convulsions, either in the form of oxidized metals, if near the surface, or metallic solids or fluids, below the reach of their action,) they still remain. These subterranean convulsions gradually diminished in frequency, but increased in power; but not for many ages was their energy sufficient to protrude the crust to an elevation above the level of the waters that surrounded the earth, after the action of the internal heat had ceased to affect them.

As the internal heat was gradually diminished at the surface, the aqueous vapor became condensed near it, and, being attracted towards the earth, was finally deposited on its surface to a great depth. Further, while the internal heat acted upon the water, in such a degree as to vaporize it freely, it would necessarily rise to a certain distance from the earth, where, being con-

densed by the cold, or, in other words, having parted with its caloric of vaporization, it would return again in the form of rain. Thus, it may be supposed, it rained incessantly, for a long period after the formation of water; although the heated surface of the earth did not admit the water to come in contact with it, before being again and again expelled in the form of vapor, to be repeatedly condensed by parting with its caloric of vaporization. This vapor, or steam, we may suppose, was so dense, for many ages, (particularly while the water was kept in a state of ebullition,) as to preclude the light of the sun; — "and darkness was upon the face of the deep."

Meantime, the subterranean forces continued to act, at irregular intervals, and with different degrees of power. Between these intervals, the surrounding waters of the earth were comparatively calm and unruffled; for the whole surface of the earth was of a uniform temperature. No

winds prevailed; — the cause of winds being attributed to the variation of temperature, in different parts of the earth, and no such variation then existed.

CHAPTER III.

We have attempted to show some of the geological effects produced upon the earth's surface, by the action of water upon it, during the very gradual reduction of the temperature of its crust. Let us, for the present, confine ourselves to some reflections on the chemical changes wrought upon the surface, by the water and gases surrounding the earth, as it passed from an igneous state to that of the temperature we now enjoy.

We have seen that the gases that now compose the air, water, and enter so largely in the composition of vegetable and animal organization, could not have been a part of the earth while in a molten state; as we know that a heat

sufficient to melt metallic bodies will expel these gases from such bodies. Admitting, then, that these gases then existed around the molten mass, we should suppose they might be attracted to that body in the ratio of their relative specific gravity or weight ; and, as carbonic acid gas is the heaviest, it would, consequently, as the earth's temperature became reduced, be the first to approach it, and become united with it. But the earth's surface was not yet prepared to admit the union of this gas with it ; — the fact being established, by the laws of chemistry, that metallic bodies will not combine with this gas, nor with any acid, until such bodies are first oxidized, or, in other words, until they form a union with oxygen. To increase the density of oxygen gas, so as to allow it to overcome the resistance of the more dense carbonic acid gas, became necessary. And how was this effected ? — By combining the two gases, oxygen and hydrogen, and forming water. This combination was ren-

dered heavier, or more dense, than either of the gases alone, and, consequently, would become the first to be attracted towards the earth. But we have seen, that, in this state, it was not allowed to approach too near the earth's surface, for a long time, without being again reduced to its original elements; and, when it was finally admitted to come in contact with the surface of the earth, in a state of extremely minute particles of vapor, it was instantly decomposed,— the oxygen uniting with the metallic surface, and the hydrogen being again driven off into space. How long this action continued, it would be difficult to conjecture; but we shall readily perceive, that many ages would be required to reduce the temperature of so large a body of molten matter to a state to admit water to approach it without being decomposed.

According to our hypothesis, the earth's surface was then composed wholly of molten metals, of the least specific gravity,—such as

sodium, the base of soda; calcium, the base of lime, &c. Had these metals been allowed to have become solidified, without having been first acted on by oxygen, they would have been unfit to perform the part assigned them by the Creator; and the earth would probably never have been the abode of organized vegetable and animal creation. But He, who planned the universe, had fixed unerring laws, by which every material had been gradually carried forward towards its ultimate destination. These metallic bodies, then, had been perfectly adapted for their union with oxygen, when the oxygen had been prepared, by its union with hydrogen, to approach them.

Let us, then, for a moment, examine the effect produced by the union of oxygen with the metals. Take, for instance, calcium, the base of lime, which, we suppose, composed a large portion of the earth's crust. When the oxygen came in contact with it, in its igneous or molten

state, it would at once assume a different appearance; its bulk would be increased, its specific gravity, or weight, would be lessened, and it would assume the form of a white, pulverulent mass, like that of quicklime, and thus remain, prepared for other changes, to be indicated hereafter. Thus, we may suppose, all the metals on and near the surface of the earth were acted on by oxygen, while the crust continued in a sufficiently heated state to decompose water; and that, during that time, all the metals were oxi dized as fast as they changed from a fluid to an igneous state.

Thus, then, the earth's surface was prepared for the reception of water, and the metallic oxides fitted for the changes to be produced by the action of water upon them. When the temperature of the earth's exterior had been reduced below the point required for the decomposition of water, the heat was still so great as to allow its approach only in a state of very rare

vapor; and this vapor, for a length of time, would be driven off so rapidly as scarcely to admit of any action upon the oxidized metallic crust. But this vapor would carry off the caloric from the surface much more rapidly than before, and soon reduce the temperature so low as to admit the vapor to be absorbed by the oxidized crust. This heated vapor would gradually penetrate the pulverulent oxides, and serve to reduce them to powder; thereby exposing their surfaces to the further action of the accumulating waters. Take, for instance, the oxide of calcium, or lime, as it is generally termed, as a specimen. The action of vapor or water upon that substance is too well known to require elucidation. But here, another agent in the preparation of the oxidized crust, for future chemical uses, was first allowed to act on it. This agent was carbonic acid gas, which, till that period, had been hovering around the earth, without being allowed to come in contact with it. The

heated and powdered oxides were then in the best possible condition for forming a union with that gas, — or, rather, so many of them as were susceptible of such union; and, when it is recollected, that all the carbon, which has since contributed to the formation of the carbonates, such as limestone, marble, chalk, and numerous others, — as well as the immense beds of coal that have since been discovered, together with the vast quantities taken up in the first formation of vegetable and animal productions, — then existed in a state of carbonic acid gas, exterior to the earth's surface; and, that this must all have been disposed of before any animal, now an inhabitant of the earth, could have lived, — we can not but admire and reverence the wisdom of that Being, who had contrived and adapted every thing for the gradual but sure progression of all the elements of matter to the purposes designed for them.

But now the steaming earth was the constant

recipient of the falling vapor; and, as the heat at the surface diminished, this vapor became gradually more condensed, until it assumed the form of rain, — when, we may suppose, that the water would slowly accumulate, and, in a state of ebullition, cover the whole surface of the earth. This ebullition, we may suppose, continued for many ages, throwing off vapor, in the form of steam, in vast quantities, and being constantly replenished by incessant rains.

Some of the molten metals, passing upwards through the water, from great depths, would serve to keep up the temperature; while the waters, resisting them, and acting on them as they passed through, would, in many instances, separate them into small rounded particles, (as melted zinc, when thrown in water, is converted into drops before cooling. Thus, we may suppose, the gold of California was separated into small particles before cooling.) Others would act on the water, and be partially oxidized.

Some of the molten rocks, when they were now protruded upwards through the waters, would separate into congeries, and, falling back into the liquid mass, would be conglutinated with it, and form what is now familiarly termed pudding-stone.

Meantime, the waters were kept in a state of ebullition; and the agitation beneath them continued; and the oxides of the metals were dissolved, and diffused throughout the boiling flood of waters, and were thus prepared for forming new chemical compounds, as the heat subsided.

CHAPTER IV.

BEFORE proceeding further, it becomes us to pause a moment, and consider, somewhat more in detail, the probable condition of the earth, when the waters around it had been condensed into a liquid form on its surface. Let us suppose, then, by way of illustration, a number of metallic bodies, combined in a fluid state, and made to assume a globular form, to be projected from the earth into the atmosphere. Let us suppose this fluid metallic mass to be capable of retaining its caloric of fluidity for a definite length of time. We know that this body, as it gradually cooled, would attract oxygen from the atmosphere, and would soon be coated with rust, or

oxides of the various metals which were exposed to its action. We are aware that this oxidized surface would be specifically lighter, and would occupy more space, than the metals did before being oxidized; and we know that the weight of the mass would be increased exactly in proportion to the weight of the oxygen with which it would combine. We know, too, that heat expands metallic bodies; and, consequently, a diminution of the heat of fluidity would contract them. The earth, then, as it parted with its caloric, or source of heat, would occupy much less space, when it should become solid, than it would before having parted with its caloric of fluidity;—and this law, it is believed, would act uniformly, from the time the matter of the earth existed in the state of gas, to the time when it would become (if it ever should) a perfect solid. From what we have said above, however, it will be seen, that the surface of the earth, by its union with oxygen and other gases,

is much less dense than the interior even in a fluid state; and, consequently, that its specific levity would cause it to remain on the exterior of the globular mass, and increase its bulk. This accumulation of rust, or earthy matter, probably extended to considerable depth, and of a uniform thickness until disturbed by the action of water. This effect has already been partially described. It will, however, be readily conceived, that, so long as the water was kept in a boiling state, a large portion of it would be suspended in the atmosphere; and, as it was spread nearly equally over every part of the surface of the earth, it would necessarily be of nearly a uniform depth, and comparatively shallow. When the waters were converted into steam, under the crust of the earth, this steam would, in some instances, be forced along for many miles before finding egress; when, bursting the solidified rocks, it would raise them from their beds, and the liquid below would be forced

upward and fill the chasm,—thus raising the crust over the whole length of its passage. But the crust could not be elevated more than its own thickness; and if, perchance, some elevations arose above the waters, the falling rain and the rising steam would still keep the oxidized surface in a soluble state.

Thus, then, were the materials for *organized* matter diffused through the boiling fluid, and prepared and adapted, each to assume the place and form for which it had been designed from the beginning. The means were, in every instance, adapted to the accomplishment of the object to be attained. The surface of the earth became an immense caldron, covered with carbonic acid and other gases, and holding in solution all the materials for crystalline, vegetable, and animal organization. The waters became turbid with the vast accumulation of these materials, owing to the small quantity, while in a state of ebullition, allowed to remain, during its

very gradual augmentation. But the time at length arrived when the temperature became reduced below the boiling heat; and a large proportion of the waters, that had hitherto been suspended above the earth, now rested upon it. Owing to the great internal heat still acting upon the waters, and the frequent protrusion of molten matter from beneath, the evaporation still continued, and dense clouds yet hovered over the earth. For, it will be recollected, that the temperature of the earth's surface was uniform; and, being still very much above that now produced, at any time, by the influence of the sun, the winds had not yet been put in motion.

And now, the waters being comparatively at rest, and being in sufficient quantities to give free scope to the action of chemical agents, the play of chemical affinities commenced. Here were all the materials for secondary rock formations, as well as crystals, and, with the aid of the gases in the atmosphere, shells, and vegeta-

ble, and animal organization. But no air-breathing animal could yet exist, on account of the vast quantities of carbonic acid that yet pervaded the atmosphere. And now commenced the formation, in the waters, of crystallized rock, and salts. The materials for quartz, settling into the crevices and interstices of primitive rock, (which had been cracked as they were lifted from the beds where they had been first cooled,) were there crystallized and solidified. Carbonates of lime were deposited in the valleys, beneath the waters, where they became consolidated. Fluid metals were frequently protruded from beneath the crust, through openings and rents, and, becoming cooled, remained till disturbed by other convulsions.

Even then, as now, Nature was incessant in her operations. The whole mass of waters, with the gases of the atmosphere, as then constituted, became a vast chemical laboratory; and the germs of mollusca and crustacea were then

generated, and became endued with life and motion; and beautiful shells were formed for their habitation, and the future development of their species.

And now began the grand operation of Nature for depriving the atmosphere of its excess of carbonic acid gas, by which the earth would be rendered fit for the habitation of the higher classes of animals. The elements of water were united, in due proportions, with carbonic acid; and the germs of vegetables, endued with the power of attracting the elements of their composition, — or, in other words, endued with life, — sprang forth from the warm and water-clad earth, and now, owing to the propitious state of the earth and air, gradually rose from beneath the shallow waters; and tall plants and herbs were formed, appearing like trees of the present age, — ferns, and other plants, which now attain the height of a few inches, then reaching the height of seventy or eighty feet!

It will at once be perceived, that the temperature of the waters, and consequently of the atmosphere, derived from the internal heat of the earth, must have been, for ages, very much higher than at present, and nearly equal over every part of the globe; — the heat of the sun having but little, if any, influence, owing to the high temperature of the earth, and the constant accumulation of vapor suspended in the atmosphere.

The waters became pregnant with life and animation; and *the germs of vegetable and animal life were formed therein.*

This uniformity of temperature, over every part of the earth's surface, at the same time, while its reduction was so gradual as scarcely to be perceived for a great number of years, will account for the frequent discoveries of the remains of tropical animals and vegetables near the poles, — instead of resorting to the theory of St. Pierre and others, that the relative situa-

tion of the poles with the equator has been changed; assuming that a part of the earth, near the poles, emerged from its watery submersion before the temperature of the water was reduced below 98°: and the difficulty of accounting for the remains of tropical animals and plants, found in the now frigid zones, will at once vanish.

Again: during the first ages of the earth's existence, when the crust was thin compared with what it now is, the hills not being so much elevated, nor the valleys so much depressed, we may reasonably assume that a very large portion of that under the water was sufficiently shallow to be left nearly dry for a great part of the time. This may account for the existence of amphibious animals, not now known; and for those herbivorous monsters which, from their structure, probably inhabited places partially covered with water. The temperature, at that time, would favor the luxuriant growth of aquatic vegetables

for their subsistence; and it is an established axiom, that the organization of every species of animal is adapted to the situation in which it is placed.

Again; we may well suppose, that the temperature of the water, being imparted to the humid atmosphere, (for evaporation would be then much more rapid than at present,) would produce a climate altogether unfit for the residence of animals and plants which are now found in the temperate and frigid zones, but would be perfectly adapted to those gigantic animals and plants fitted by Nature for the habitation assigned them. We know that tropical climates now produce plants and animals more abundantly, and much larger, than those of a lower temperature. We know, too, that the incipient development of the embryo of animals, as well as the germination of plants, requires a uniform temperature, accompanied by humidity; and we are not aware

that any animal or plant, now existing, could have been generated, or matured, at a temperature uniformly below 60° Fahrenheit. It was remarked, by the master of a ship, who was becalmed, for a number of weeks, near the equator, that the waters around his ship literally teemed with life and animation. How prolific, then, must have been the waters during the immense number of ages that were required to reduce their temperature from a boiling heat to that which now prevails! So uniform was their temperature, and so little motion prevailed, (except when agitated by convulsions from beneath the crust of the earth,) and so active were the chemical materials within them, that the immense mass of water, surrounding the globe, was *stagnant with animation;* and, as the temperature became reduced, they became pregnant with life, and the germs of all organized living forms were generated, as the waters passed through

the various temperatures required for the combination of atoms with atoms, and atoms with germs.

CHAPTER V.

We have stated, that the heated waters became a vast chemical laboratory; and, as they passed through every temperature, *very gradually*, from a state of extremely rare vapor to the freezing point, every chemical combination necessary to the formation of all crystalline and vegetable organization might then have taken place. Here were all the materials which now exist in crystals, as well as in vegetable and animal organization, in a state of solution;—the temperature of the solvent being sufficiently uniform to complete any organized form that might have been required. Here, too, was a warm and humid atmosphere, without winds, containing electricity,

and the vital principle ; but at first so saturated with carbonic acid, as to require its removal before any animal, dependent on atmospheric action for life, could exist.

And now the still waters teemed with animalcula ; and these animalcula were the seminal germs of organic life of the lowest orders. And the seminal germs of plants were formed, and a vegetable world sprang into existence, the rapidity of whose growth was almost incredible. for the gases were abundant, and the waters still warm. There were no changes of temperature to check their growth. The bud needed no glutinous covering ; the seed, no hardened shell ; the tree, no scaly epidermis, — to protect it from the winter's cold. Scarce had the bud been formed, ere it was expanded ; or the seed, before it would vegetate anew.

The still, murky atmosphere yet shaded the earth with dense clouds ; and, there being no winds, the sun's light had not yet fully penetra-

ted to the humid surface. The vegetable growth, although gigantic and rapid, was weak and succulent, and the decay rapid. But organic life was imparted to organic decay; and the latter became revivified, and subject to new organization.

Meantime, the shallow waters, together with such places as had risen above them, were soon covered with vegetable remains. And now commenced the formation of those immense beds of carbon, or coal, which have since been discovered, and which contribute so largely to the comfort, if not to the very existence, of man, in the temperate and frigid zones. This coal formation, it is believed, could not have taken place under the present low and variable temperature of the earth's surface. This arrangement was also necessary, at that time, to deprive the atmosphere of the excess of carbonic acid, which remained after the formation of carbonates and vegetables, in order to render the air sufficiently

pure for the habitation of the higher classes of animals.

And now, the temperature of the waters being sufficiently reduced, and the atmosphere having been prepared to impart vitality to the higher classes of organized beings, the design of the Great Architect of the universe was to be further developed, — and the organization of living animals commenced. The waters teemed with the embryo germs of animals, in the shape of animalcula, of all forms, — each adapted to fit it for the place to be occupied by it, in the situation of the habitable globe at that time. The molecules of matter were arranged and shaped by the unerring laws designed for them in the beginning; and they were endued with life, and motion, and instinct. The waters became animated with them. The instinctive impulse for food, generated in them a spirit of war; and they fell upon and devoured each other, — the stronger overcoming the weaker. Those that

escaped waxed strong and increased in size; — some, attaching themselves to the succulent plants, were nourished by their juices; others, deriving sustenance from other species which they devoured, — or, attaching themselves to them while living, were sustained and matured by the vital fluid which was thus yielded to them. The waters were at rest. Food alone was required, to bring to maturity the new-formed germ. No mother's warmth was needed to bring forth the embryo egg, (if the egg was necessary,) for the waters afforded the requisite heat; — no calcareous shell, to protect it from a change of temperature. As the animals grew, the tender and succulent plants furnished food for some, and the teeming waters, rich with living materials, contributed to the sustenance of others.

The elementary atoms, being endued with attraction and life, were brought together, and arranged in every kind of living form which the

temperature of the waters, and the atmosphere, were adapted to mature and sustain. These elementary atoms, being once combined, and endued with life and motion, were governed by fixed and unerring laws, in their organization, and required a uniform temperature for their preservation. And, in order to perpetuate these organizations, under the variable temperature of the earth, Nature has employed a method of keeping up a uniform heat, by endowing each organization with a capacity for sustaining and preserving this uniformity of heat, under all conditions of life, and adapted to the requirements of each individual organization.

Thus, then, each organized plant, or being, was fitted for the place it was to occupy; and the place it was to occupy was perfectly adapted to its habits or mode of life. The materials for the shell of the crustacea and testacea were prepared for the action of the germ of those animals upon them, and grew with their growth, and

strengthened with their strength. Then, the materials were abundant, and the changes rapid. All was change, — no death. The dissolution of organized matter furnished food for new organizations, (even as the food taken into the animal stomach is carried to the laboratory in the blood, and thence to the part requiring it, where it again becomes a part of the living system;) and the uniform temperature of the waters and the atmosphere contributed to the rapid development of every kind of combination adapted to it.

The higher animals seem, in some instances, to have been a combination of inferior organizations; and each species, or class, to have been perfected through a successive, and progressive, but regular, gradation, from the lowest to the more perfect of their kind.

But the prolific waters were the medium of generation of huge aquatic vegetables; monsters of the deep, animals long since extinct, (or, if

any specimens remain, they have dwindled to the mere pigmies of their race,) lived, and dwelt, and died in them. Huge fishes, of which history furnishes no trace, (unless we except the leviathan of the deep,) of immense length and size, as indicated by the fossil remains which have since been discovered, inhabited the waters. Reptiles, too, of the saurian or lizard tribe, of enormous length, crept or waded over the softened earth. Here, too, the mammoth, — ninety feet in height, with tusks to uproot, and trunk to pull down, the immense trees of the forest, — (this trunk having served as a duct for the conveyance of air to the embryo, as it was partially matured beneath the waters,) — roamed on the land, or swam in the seas, devouring the herbage either under or above them. This species is now only represented, in miniature, by the elephant of tropical climes. The hippopotamus, or river-horse; the huge rhinoceros, whose love for the soft and miry earth, as then exhibited, and

for which he was formed, still continues; — the megatherium, mastodon, megalonyx, — and many others, whose remains have been preserved, and their habits and forms indicated by the science and ingenuity of man, — then existed.

These animals, and vegetables, could not have attained their immense size, except under peculiar circumstances, favorable to their growth; — among which, evidently, the high uniform temperature, and humidity of the earth, at that time, stand conspicuous. These gradually gave place to other species of animals and plants, of minor proportions, when the reduced temperature of the earth's surface no longer provided them with sufficient warmth and sustenance. Then, every thing was gigantic: but, as the waters cooled, new organizations were effected, of less magnitude, but of more perfect development, in the still fruitful waters.

CHAPTER VI.

It will be recollected, that all animals, even at the present day, as then, require an immersion in a liquid, of a uniform temperature, for the primary development of their instinctive, or, what may be termed, vegeto-animal growth. The analogy of the animal to the vegetable, in the embryotic stage of growth, is much stronger than might be supposed. Both require heat and humidity; both receive liquid nutriment, through ducts or tubes attached by fibrous appendages to the object or place whence they receive their nourishment; and neither are capable of receiving vitality from the air, until the unfolding of certain apparatus, which in the former are called

lungs, in the latter, leaves; and this apparatus, in each, requires the stimulus of the oxygen of the atmosphere to bring it into action.

Thus, then, in the dark, still, and warm waters, the germs of vegetable and animal life were generated; their vegetable, embryotic stage of existence matured; and the classes intended for locomotion, whether in the water or upon land, endued with an impulsive sensation, or instinctive faculty, which subsequently directed them to the attainment of the means of supplying their natural wants, as well as of preserving and perpetuating their species.

Meantime, the internal convulsions were raising the earth's surface, and often forcing the molten matter through it, in various locations; and the waters, accumulating in the valleys, depressed the crust beneath them, thereby causing the elevations and depressions to present a greater irregularity on the exterior, than had hitherto existed.

As the waters receded from the hills to the valleys, immense bodies of coal, which had been deposited, together with shells of every description, (some of which had become agglutinated, and formed into limestone,) remained on the oozy surface; — crystals of all kinds, — vegetable and animal remains, which had been formed, endued with life, and died, — were strewn over the land, or mixed with molten rock which had become solidified; and many of which had become, or were becoming, extinct, by the change of temperature in the waters. These, with countless others, still represented by living specimens, were exposed on the surface, or imbedded in the soft alluvial deposits formed by vegetable decay. Thus was the land, as it became drained, prepared with decaying materials for the future growth and perpetuation of the inhabitants destined to occupy the situations intended for them.

The waters continued to cool; — all the changes having taken place beneath them of which the elements of matter diffused therein were susceptible. The design of the Creator had been accomplished, in preparing the earth for a habitation, and in producing a race fitted to inhabit it. The waters were no longer of a uniform temperature. The central heat not acting with sufficient energy, at the poles of the earth, to maintain an equable heat over the whole surface, a current was formed, and the winds were set in motion, whereby the air was impelled from a more dense to a rarer medium. But so gradual was the change, (as had been all changes since the formation of the fluid globe,) that the direction of the vapor, arising from the earth, was, at first, scarcely swayed from the perpendicular motion which had hitherto governed it. But, as the temperature of the waters became farther reduced, the winds increased in

force; and the reduction of the heat of the waters became more rapid as their motion was accelerated.

Finally, the vapors were condensed in masses, or clouds, and dispersed, or carried upward from the earth, to be again diffused upon it in the form of rain. The winds blew, and the clouds were dispersed; and, for the first time, the sun, in all his splendor, shed his refulgent light, in unobstructed blaze, upon the visions of the dwellers of the then habitable globe.

With what amazement, wonder, and admiration, did man, then, for the first time, (for man was there, — the last product of living material organization, in the uniformly heated waters, — partaking in a degree of the nature of all others, yet more perfect than any, — endowed with a capacity, but which had not yet been developed, for aspiring to the perfection of his Creator,) — behold the heavens, spread like a canopy over him, with countless glittering lights, sparkling

like diamonds, and apparently almost within his grasp! There, too, was the pale moon, shining with softened light, and, for the first time, imparting its direct and unobstructed influence upon the waters; (for its action had been partially checked by the quantity of water diffused through the atmosphere;) and the tides swelled the deep waters, where they had been gathered into oceans; and they were attracted towards the moon, as if seeking her favor; and a regular motion was given them, subject to the action of winds; and they became cooled, and agitated; and the animals thereof became a distinct class, and fitted only for the habitation for ever after assigned them.

The winds, passing over the land, which had emerged from the sea, together with the heat of the sun, caused it to become dry; and the animals, including man, became the appropriate occupants thereof. "And there were giants in those days," — for the warm temperature, under

which their vegeto-animal organization had been developed, had given them, as well as all other animal and vegetable productions, a grandeur proportioned to the influences employed in their production. Man, however, was only superior to other animals, at that time, by the capacity for improvement imparted to him by his Creator; — but the development of this capacity was very gradual, so that, we may suppose, for ages after he had become an inhabitant of the earth, his existence was not marked by any very striking superiority over other classes of the higher order of animals.

We have now, very briefly, step by step, endeavored to mark out some of the events deducible from the premises laid down in the commencement of this little treatise. If any new facts have been educed, tending to throw additional light upon this hitherto inexplicable but interesting subject, the writer will deem his

labor well bestowed: or, if it shall induce others, of more leisure, and higher scientific attainments, to continue the investigation, — whatever be the result, — it is believed, mankind will be benefitted by the examination.

THE END.